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A MINIATURE STEAM-ENGINE.

By the kindness of our correspondent, Mr. Max Kohl of Chemnitz, Germany, we are enabled to present to our readers an illustration of a miniature steam-engine, recently constructed in his establishment. Although so small as to fit easily within its case, composed of an ordinary walnut shell, the little machine is a practical working model, correctly and completely finished in all its parts. The cylinder, which is supplied with a complete sliding valve, is 5.5 mme. in length and has a bore of 2 mme. The boiler is 20 mme. in length and 8.5 mme in diameter. The diameter of the fly-wheel is 10 mme. and that of the steam channels 0.2 mme The slide is 1.8 mme. in length and 1 7 mme. in breadth. The machine is furnished with safety-valve, waste-cock and funnel. The model is to be driven with a spirit lamp, but it can also be put in motion by means of a thin rubber tube, the one end of which is to be screwed in the funnel on the kettle, while the other end is supplied with a mouth f r blowing air into the kettle. The model only serves to show in what small dimensions working steam-engines can be made.

SCIENCE

NEW YORK, DECEMBER 23, 1892.

THE GROWTH OF CHILDREN.

BY FRANZ BOAS.

DURING the past years a vast number of observations referring to the growth of children have been accumulated. The method of treating the results of such observations has been largely a comparison of averages and of the frequency of occurrence of cases between certain limits, for instance, frequency of occurrence of statures from inch to inch, or of weights from pound to pound.

In discussing the results of such observations, the question arises in how far the results have a physiological meaning and in how far they are purely statistical phenomena. It is generally assumed that the figures express physiological facts.

Serious objections, however, may be raised against this point of view. In almost all cases, excepting observations like those of Wretlund, Malling Hansen, and Carlier, the observations have been taken only once on a great number of individuals, not repeatedly through a long number of years on the same individuals. For this reason the classes, when arranged according to ages, will be differently constituted. The younger classes contain many individuals who will not reach the adult stage, while the older classes contain only few individuals who will die before becoming adults. When we assume that all classes are equally constituted, we assume implicitly that the value of the measurement under consideration has no fixed relation to the mortality, which assumption seems to be very doubtful. Without considering details, it would appear very likely that individuals far remote from the average, showing either too small or too large measurements, approach the limits between physiological and pathological variation, and are therefore more likely to die. This would imply a greater variability of the measurements of deceased individuals of a certain age than of the living individuals of the same age. The series of living individuals of all ages can be equally constituted only when the measurements of the living and the deceased show the same values. This fact has already been pointed out by H. Westergaard ("Grunzüge der Theorie der Statistik," p. 188).

We have a few observations which seem to make the identity of the series of measurements of the living and of the deceased individuals of the same age very improbable. The most important among these is the peculiar decrease in the brain-weight after the twentieth year in males. This can hardly be explained in any other way than by assuming an increased death-rate among men with very large brains at an age of about twenty years.

Bowditch and Roberts have shown that, on the average, children of well-to-do parents are taller and heavier than those of poorer parents. Carlier has shown the same phenomenon by proving that a number of children of a certain class when brought under more favorable conditions (i.e., in a military training school) grow more rapidly than the rest who are left in their former conditions. We know that the mortality of children is greater among the poorer classes than among the well-to-do classes. Therefore among the young children a greater percentage belongs to the poorer classes, who are at the same time shorter of stature, than among the older children. This fact expresses itself undoubtedly in the averages of measurements collected in our public schools.

These considerations seem to me sufficiently important to doubt the physiological value of any figures obtained by means of single observations. It does not seem unlikely that the correlation between measurements and mortality is more strongly emphasized at certain periods than at others. If, for instance, many individuals of retarded growth should die during the period of adolescence, this might give the real explanation of the curious overlapping of the curves of growth of girls and boys, the girls being heavier and taller than boys between about the twelfth and fourteenth years. I am strengthened in this opinion by the observation made by Dr. G. M. West, that the extent of this period and the amount of overlapping is the smaller the more favorable the conditions under which the individuals live. It would be interesting in this connection to study the curves of a people which has a very high death rate among young children.

A second point of view which seems to limit the physiological value of the curves relating to growth is the following. I have shown on a former occasion (*Science*, Nos. 488 and 485, 1892) that, owing to the asymmetry of distribution of cases in the years preceding maturity, the average of all observed values cannot be considered the most probable value belonging to the age under consideration. I have also shown that this asymmetry and the increase of variability during the period of adolescence are purely statistical phenomena. Dr. H. P. Bowditch, in his interesting discussion of the growth of children (22d Annual Report of the State Board of Health of Massachusetts, p. 479 ff,), has compared children of the same percentile rank from year to year. He discusses the feasibility of such a proceeding and considers it likely that the same children on the average will remain in the same percentile grade. I believe it can be shown that the children are more likely to vary in rank than to remain stationary in this respect. Any correlation between measurement and mortality must have a disturbing effect. Besides this, we will consider for a moment all those children separately who will, as adults, have a certain percentile rank and investigate their position during the period of rapidly decreasing growth, during adolescence. It seems reasonable to assume that the average individual (not the average of all individuals) will retain its percentile grade throughout life. For instance, the man of the eightieth percentile grade will have belonged to the same grade when a seventeen-year-old boy. At this period a number of these individuals will be in advance of their age, while others will be retarded in growth. It seems likely that the retardation or acceleration is distributed according to the law of probability. As the amount of growth is decreasing rapidly at this period, the number of retarded individuals will have a greater influence upon the average than those of accelerated growth, that is to say, the average of all observed values will be lower than the value belonging to the average boy of seventeen years of age, and as the latter will probably have the same percentile rank throughout life, the average will represent a different percentile rank. We can show in the same way, by comparing the composition of the same percentile grade year after year, that its composition must change. During a period of retarded growth the individuals in advance of their age will be less remote from the percentile rank in question than those whose growth is retarded. Therefore the composition of each percentile grade cannot remain constant.

The interest of a knowledge of the actual anthropometric conditions of children of a certain age shall not be depreciated, but this raw material does not allow us, or at least allows us only in a very imperfect way, to draw inferences of physiological value. In order to enable us to draw these inferences, the material which we make a subject of our study must be in every way homogeneous. This can be accomplished in two ways. A very large number of children may be measured once, and year after year those who die and those whose further fates are unknown must be eliminated from the list. When all have become adults, the survivors and those who died during their first, second, third, etc., years must be treated separately. Furthermore, pains must

be taken to discover if any marked difference exists between the social composition of these groups. While this method may give satisfactory results at a moderate expense, it is far inferior in value to the method of repeated measurements at stated intervals. In this case the same subdivisions must be made, and changes in the social status and in the health of individuals must be recorded and eliminated. In order to carry out such a plan, it would be necessary to organize a bureau with sufficient clerical help to carry on the work. The questions underlying physical and mental growth are of fundamental importance for hygiene and education, and we hope the time may not be far distant when a work of this character can be undertaken.

SOME ODDITIES IN BIRD-LIFE.

BY C. W. SWALLOW, WILLSBURGH, OREGON.

IT is not my intention, in this article, to describe any new species that are unknown to ornithologists, but there are many nature-lovers that cannot identify the birds easily; with such, I hope these descriptions may help and create a stronger desire to know more of the birds.

I will try to describe a few birds that are not as well known to the general observer as the robin, and which, by their rarity or peculiar habits, make them especially interesting to study.

The first species I will notice is Townsend's Solitaire (*Myadestes townsendii*). This is a rare bird to me, as I have never secured but one specimen. It may almost be called a hybrid between the thrushes and flycatchers, yet, by its color and flight, it somewhat resembles the shrikes. These birds are not as large as the robin, being a more slim bird with longer tail. They measure in inches somewhat as follows: Length, 8.5; extent of wings, 13.5; wing, 4.5; tail, 4.25; tarsus, .75. Their bill is about one-half inch long and strongly resembles the flycatchers, being broad and flat and slightly toothed. Bill and feet are black; the back is brownish ash, or slaty; the breast is lighter, shading into light ash on the crissum; top of head brownish black, lighter at base of bill; throat light ash; a light ring about the eye; wings and tail brownish-black; primary wing-feathers slightly edged with white and the secondary wing-feathers and outer tail-feathers quite extensively white-edged, the primaries and secondaries with a spot of yellow or tawny, giving the wing the appearance of having a bold bar of this color at the point of primary coverts; tail forked and slightly double-rounded.

This seems to be the only species of the genus found in the United States. They are probably more common between the Rocky and the Cascade ranges; but stragglers may be found west of the Cascades, even to the Pacific Coast; as I am informed by Mr. R. H. Lawrence that the species has been taken at Astoria. They are reported from New Mexico by A. W. Anthony in the *Auk*. Dr. Coues gives their range as north to British Columbia, stating that they build on or near the ground, laying bluish-white eggs, spotted with brown.

The Bushtits (*Psaltriparus*), although very small, dull-colored birds, are quite interesting and odd, as is also their nest, which is an ingeniously woven, pensile structure that may be found in bushes at the height of one's head, or twenty feet or more up in trees. One that I found last spring was near the end of a long hemlock limb, about twenty feet from the creek over which it hung. It was securely fastened to the small, slender twigs in three places. It was about nine inches long and four and one-half in diameter, outside. It was well and thickly woven, of moss and cottony substance, being strong enough to hold a number of pounds weight. The entrance was a small hole in one side near the top, and the bottom was well lined with feathers. They lay from six to nine small white eggs. These diminutive birds are only about four inches in length, with short, rounded wings less than two inches, and a narrow graduated tail somewhat longer than the wing. They are of a slate color above, shading into ashy on the under parts. They have no bright colors and are not crested. Bill and feet black. These lively little busybodies keep up a continuous twittering as they flit from twig to twig. There are but a few species found in the United States.

Psaltriparus minimus has a brown crown patch, while *P. plumbeus* has a lead-colored crown like the back.

P. lloydi has an ashy crown and black bars on sides of head. This is a southern bird, while the other two may be found as far north as Oregon or Washington.

A DEFINITION OF "SOLUTIONS."[1]

BY C. E. LINEBARGER, CHICAGO, ILL.

WITHIN recent years great progress has been made in our knowledge of solutions. This has been in main due to the application of the laws established for gases to solutions. Solutions are intermediate between liquids and gases. The theory of gases has been well developed, and the next problem is to devise a general theory of liquids. There are two ways of getting at the nature of liquids, — through the critical point and through solutions. Pellat[2] has recently shown the need of precision in the definition of the critical point, and has deduced from a consideration of the iso-thermal curves of carbon dioxide determined by Andrews[3] a definition at once concise and precise. It is my intention in this paper to subject to examination the existing definitions of solutions, and, if they be found inadequate or inaccurate, to propose another. Definitions, the preliminaries of science, are but landmarks of classification As scientific knowledge advances, the classifications and definitions change: they are provisional and progressive. Until within a few years, our notions of the nature of solutions were so vague that it was not possible to insist upon precise definitions; but now that we have a theory of solutions that rivals the theory of gases in simplicity and even surpasses it in the accuracy of its experimental results, it is time that a suitable definition be adopted.

Among the formal definitions of solutions (which are not very numerous) of acknowledged authorities, I will quote for the sake of comparison the following:—

(*a*) "Auflösung heisst, wenn sich ein fester Körper mit einer Flüssigkeit (einem tropfbar-flüssigen Körper) so verbindet, dass er in dieser Verbindung flüssig wird. . . . Die Flüssigkeit nennt man dann das *Lösungsmittel*, der vorher feste Körper heisst *aufgelöst*, und die neue Verbindung eine *Auflösung*" (Berzelius, Lehrbuch der Chemie, I., 424, fifth edition).

(*b*) "The liquefaction of a solid or gaseous body by contact with a liquid, the solid or gas being diffused uniformly through the liquid and not separating when left at rest" (Watts' Dictionary of Chemistry, article Solutions).

(*c*) "Lösungen sind homogene Gemenge, welche man durch mechanische Mittel nicht in ihre Bestandteile sondern kann" (Ostwald, Lehrbuch der allgemeinen Chemie, I., 606).

In these typical definitions there are three questions that require examination: (1) What is the state of aggregation of solutions? (2) Is homogeneity necessarily a characteristic of solutions alone? (3) What is to be understood by mechanical means, and is it true that solutions cannot be decomposed into their constituents by such means?

As to the first question, it is seen that the two first definitions regard a solution as liquid, which is, indeed, the common conception. Yet undoubtedly solids have the power of dissolving one another under certain conditions, so that a solution may be solid.[4] The expressions "solutions of gases in gases," of "liquids in gases," and even of "solids in gases" are quite general and used by good authorities. Thus the state of aggregation of solutions may be gaseous, liquid, or solid. (See, however, the definition proposed below).

But are there not homogeneous mixtures that are not solutions, no regard being had, however, to mixtures of powders, etc.? Every one knows what solutions of crystalloids, such as sugar or

[1] By solution is understood in this paper the ready-made mixture, no reference being had to its mode of formation; for the action of the solvent upon the substance to be dissolved as well as the product of the action is commonly called a "solution."

[2] De la Definition et de la Determination du Point Critique, Jour. de Phys. (3), I., 225.

[3] Phil. Trans. II. 1869.

[4] Van't Hoff, Zeitschrift für physikalische chemie, 5., 322.

salt, are like, and that is perhaps the reason that so little attention has been paid to the definition of solutions; what every one has a clear idea of, hardly needs defining. But when we come to speak of solutions of colloids, difficulties arise. It is not hard to distinguish true solutions of crystalloids, for they are characterized by the circumstance that for every temperature there is a fixed and constant ratio between the quantities of substance dissolved and solvent. But when we come to apply this criterion of solubility to colloid solutions, we find it insufficient. Some maintain that such solutions are in reality nothing but suspensions or emulsions[1]; and indeed this may be true in certain cases, for there exist as wide differences between colloids and colloids as between crystalloids and colloids. But the question at issue is, Can a suspension or emulsion remain perfectly homogenous for an indefinitely long time? The question can be answered in the affirmative in the case of suspensions or emulsions in which the suspended or emulsified particles have the same density as the suspending or emulsifying liquid. This is an extreme case, it is true. Still it proves that there may be entirely homogeneous mixtures which are certainly not solutions.

Again, it may be said that the surface tension between the extremely small emulsified or suspended particles and the liquid may be so great that, in comparison with it, gravity vanishes. According to this, even if there existed a difference of density between the particles and the liquid the emulsion or suspension would remain as such indefinitely. Their exist then homogeneous mixtures that may not be true solutions.

Further, under certain conditions, a true solution may become heterogeneous. If one part of a solution be at a different temperature or pressure from another, diffusion will take place and the solution will cease to be homogeneous.

With reference to the third question, probably all will agree in understanding by mechanical means, in this connection, filtration, subsidation, etc. In regard to subsidation, it has been shown above, that many emulsions and suspensions do not subside even after the lapse of a long time, so that this criterion fails in this respect. But let us see if we cannot separate a solution into its constituents by means of filtration. Take a solution of casein in dilute sodium carbonate, for instance. This passes quite freely through ordinary filter-paper; but if the paper be converted into parchment paper, although the sodium carbonate still passes quite freely through its pores, the casein is retained. If now an amorphous precipitate of ferrocyanide of copper be deposited in the parchment paper, even the salt is kept back, only the water being able to pass through the interstices of the precipitate. Thus by mechanical means a solution has been resolved into its component parts.

We conclude, then, that the existing definitions of solutions are inadequate; it remains to propose another more in accordance with fact.

Scientific definitions generally consist in the statement of certain attributes that separate as by a boundary the thing to be defined from all other things. If, then, there exists some attribute of solutions which is ever present, and indeed characterizes them as such; if other attributes are but different modes of expressing this essential attribute, such an attribute can well serve to define solutions. An attribute that fulfils the above conditions is the osmotic pressure. A solution is accordingly a *homogeneous mixture exerting an osmotic pressure.*

It is, of course, assumed that temperature and pressure are constant, else a solution might cease to be homogeneous. As osmotic pressure is a term applied only to mixtures in the liquid or solid state, it follows that "gaseous solutions" do not exist. For a "solution" of a gas in a gas, mixture is much the better term, and is indeed in common use; for a solution of a liquid in a gas, the proper word is still mixture, as well as for the rare case of the "solution" of a solid in a gas.

That osmotic pressure is the true criterion of solutions has strict scientific warrant. As soon as the conception of a pressure in solutions analogous to that in gases was gained, a great stride in advance was made. The most striking properties of solutions, diffusion, lowering of the freezing point, raising of the boiling point, are directly due to osmotic pressure; hence if osmotic pressure be predicated of solutions, it is implicitly stated that they diffuse, boil at a higher and freeze at a lower temperature than the solvent. All other properties of solutions are also more or less directly referable to osmotic pressure. The definition proposed is, therefore, entirely adequate, sharply separating solutions from all other mixtures.

[1] See my paper "On the Nature of Colloid Solutions" in American Journal of Science for March, 1892.

TEXAS GYPSUM FORMATION.

BY DUNCAN H. CUMMINS, AUSTIN, TEXAS.

PROMINENT among the strata composing the Permian formation in Texas, are the Gypsum Beds, which, taken with those of the north-west, are the most extensive of any such formations in the world. The Texas beds extend over an area of upwards of six million acres. Extending from the north line of the State, south, to the line of the Texas and Pacific Railroad, the beds vary in thickness from that of a sheet of paper up to seventy-five feet. The east line of the deposit passes Sweetwater, on the line of the Texas and Pacific Railroad, in Nolan County. The west line passes about twenty miles east of the Staked Plains. The greatest thickness of these beds is about nineteen hundred feet.

There are six forms of gypsum to be found in these beds, all contain the same chemical ingredients, but differ in their manner of crystallization: selenite, rose, massive, radiated, and fibrous gypsum, and alabaster.

The selenite is a clear, transparent variety, and may be split into very thin slices. Excellent cabinet specimens of this variety may be found in the red clays near Guthrie, in King County.

Rose gypsum is a foliated selenite, found only in one place in this belt, so far as has been reported, and that near Sweetwater, in Nolan County. The plates are fixed in the form of a rose and are so called by the people of that vicinity.

Massive gypsum is the principle form of which these beds are composed, this form occurs in beds of varying thickness at different horizons, ranging in thickness from one inch to seventy-five feet throughout this belt. It is generally white in color, but often it possesses a blue or reddish cast.

The radiated variety is usually round in figure, the lines of crystallization diverging from a common centre. This form possesses high specific gravity.

Fibrous gypsum, or satin spar as it is sometimes called, occurs in white or slightly colored deposits throughout this belt. Very few of these seams exceed two inches in thickness, although there may be seen in the museum of the Texas Geological Survey blocks of this form, from Kent County, exceeding twelve inches in thickness.

Alabaster occurs in many localities throughout the gypsum belt. Its beauty as a cabinet specimen is due to its color and translucent structure. It may be carved into many ornaments, and is capable of receiving a high polish.

Besides these six distinctive forms, the gypseous marls and the heavy beds of gypsiferous sandstones occur in great abundance throughout this area. Many of the above-mentioned forms have beautiful combinations and weatherings. Noticeable among these are a puddingstone gypsum, a combination of blue and white massive gypsum, a striated form composed of alternating layers of red and white massive gypsum, and a form of alabaster exhibiting very peculiar weatherings, grooves being washed in many directions on its surface, also a beautiful cabinet specimen from King County, it being round nodules of alabaster or selenite with a heavy incrustation of carbonate of copper.

On account of the scarcity of transportation, no uses are being made of these vast beds, which are unexcelled for use as fertilizers, or the manufacture of plaster of Paris.

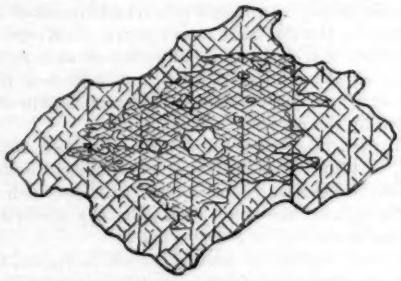
In conclusion, to the scientist, Texas presents opportunities for study excelled by no place. Her geological and mineralogical products are subjects for discussion the world over, and no prettier field is open for investigation than the Texas gypsum formation.

ON INTERGROWTHS OF HORNBLENDE WITH AUGITE IN CRYSTALLINE ROCKS.

BY WM. H. HOBBS, MADISON, WIS.

THE question of the primary or secondary origin of hornblende in a number of types of eruptive and metamorphic rocks is one of the most difficult to answer of any that are raised by their study. The number of varieties under which the calcium magnesium iron silicates that we call hornblende occurs, makes it a somewhat difficult matter to correlate results. The term "Uralite," which Gustave Rose applied to a fibrous hornblende from the Urals, which was pseudomorphic to hornblende, has sometimes been loosely applied to any variety of hornblende which may be supposed to have this origin. Other observers have distinguished "compact hornblende" from uralite, and have also carefully stated the character of the mineral's absorption. Uralite, when applied with the proper restrictions, is always an alteration product of pyroxene. It is a matter of the commonest occurrence to find basic eruptive rocks, particularly diabase, in which the alteration of augite to this mineral can be clearly seen. As regards the compact variety, it has been described as secondary to augite by Hawes,[1] Irving and Van Hise,[2] and Williams.[3]

In the beautiful monograph on the "Eruptive Rocks of Electric Peak and Sepulchre Mountain, Yellowstone National Park,"[4] Professor J. B. Iddings devotes considerable space to the description of very interesting intergrowths of augite and hornblende, both in diorites and glassy rocks. The author uses the opportunity to raise a strong doubt as to the secondary nature of compact hornblende in those cases in which it has been described. Because of



the deservedly wide reputation of Professor Iddings, his generalizations regarding this point will be received with much consideration. It has seemed to the present writer that Mr. Iddings should have made mention of earlier descriptions of intergrowths of these minerals where the primary nature of the hornblende has been as clearly demonstrated as in the cases he describes.

Parallel intergrowths of augite and hornblende have been frequently observed in eruptive rocks. Teall,[5] Rohrbach,[6] myself,[7] and probably others have figured them. Rohrbach described intergrowths in a teschenite, from the Teufelsgrund, in which the hornblende has its own outlines and is sharply outlined from augite. Chemical analysis showed an essential difference in composition between the augite and hornblende. I have described very similar growths in the augite diorite from Medford in Massachusetts. Here the hornblende is the brown variety and the augite the pink variety common in diabases. That the hornblende is primary is shown not only by its idiomorphic character, but also by the fact that the augite is sometimes almost entirely altered to clorite, the hornblende remaining fresh. Professor Iddings's conclusions will doubtless go far toward correcting any tendency to describe compact hornblende as secondary when the principal basis for it is the analogy with uralite, as his observation of an instance of hornblende altered to augite brings into the study of the relations of these minerals a new complication.

I have recently observed some rather unusual intergrowths of augite and hornblende in a rock from the "Cleveland Gold Mine" in New Marlboro, Mass. The rock is largely composed of these minerals, but is slightly calcareous and is apparently a phase of crystalline limestone. Nearly all the crystals represent intergrowths, the hornblende generally predominating and enclosing the augite, which is of irregular outline and oriented like the hornblende. Prismatic sections show a wide divergence in the extinction angles, and the hornblende is light-green and pleochroic, while the augite is almost colorless. The intergrowth figured is interesting because the augite in this instance completely surrounds the hornblende, a structure that I think is rare, as I have not seen it described. The section is nearly perpendicular to the *c* axis, since the cleavage angle in the augite was measured as 89°–90°, and that of the hornblende as 125°. While sharply contrasted by differences in their color and cleavage angle, the two minerals are more markedly distinct in polarized light. I have noticed other instances of intergrowths of these minerals within the same area, but this is the only one where hornblende was seen to be entirely enclosed by augite.

An examination of the section figured will show how intricate is the intergrowth. Islands of augite are enclosed within the hornblende. A somewhat pronounced parting parallel to the clino-pinacoid passes through both minerals. There seems to be considerable similarity between intergrowths of these minerals and the quartz which is so often enclosed within the feldspar of pegmatites. The hornblende, like the feldspar, is most frequently the enclosing mineral, and in the instance described by Rohrbach it is, like the feldspar, the more basic of the two minerals.

[1] Mineralogy and Lithology of New Hampshire, Plate vii., Fig. 1.

[2] Geology of Wisconsin, iii, 170; iv., 662. American Journal of Science (3), xxvi., 29.

[3] Ibidem, xxviii., 259–268.

[4] Extract from the Twelfth Annual Report of the Director of the U. S. Geological Survey.

[5] Quarterly Journal of the Geological Society, London, xl., 653, Plate xxix., Fig. 3

[6] Ueber die Eruptivgesteine in Gebiete der schlesischen-mährischen Kreideformation. Min. u. petrog. Mitth., vii., 24, Plate i., Figs. 1-7.

[7] On the Petrographical Characters of a Dike of Diabase in the Boston Basin. Bull. Comp. Zoöl., Harv. Coll., xvi., 10, Plate i., Fig. 2.

OPTICAL ANGLE AND ANGULAR APERTURE.

BY ALFRED C. LANE, MICHIGAN MINING SCHOOL, HOUGHTON, MICH.

THE observation of the brilliantly-colored images which are given by various crystals, natural and artificial, in polarized light is of considerable diagnostic value. The apparent breadth between the two branches of the hyperbola which may be seen in the image given by many biaxial substances, e.g., white mica, is dependent upon the optical angle,—a constant characteristic of them. The relation between this breadth and the "optical angle in air" (2E) is usually found by noting the apparent breadth in the case of a plate whose optical angle is somehow otherwise known (see Iddings's translation of Rosenbusch's "Microscopic Physiography," also Czapski in the Neues Jahrbuch für Mineralogie, etc., 1892, supplementary vol. vii.).

I wish to describe briefly the very simple method that I use for determining said relation, which also may be used *to determine the angular aperture of the objective.*

It works well in class, and the only reason why it has not long ago been adopted seems to be that the German microscopes on which the technique of the subject has been developed are not built to admit of it. But any microscope whose mirror-bar is graduated to measure the obliquity of the light will do.

We will suppose, then, that we have such a microscope, that above and below our plate of mica we have nicols, below it a strong condensor, and above a short-focus objective.

We may use a camera and project the image with its hyperbola on paper, but we will suppose that instead of that we use a Bertrand lens, which slips into the tube between eye-piece and objective, and with the former makes a compound microscope which magnifies the image given by the objective alone. We will also use a micrometer eye-piece. To measure the distance between the hyperbola branches, the micrometer scale must run diagonally. After noting the position of the branches on the scale, turn it till it runs right and left, the same way that the mirror swings. Then, without altering the distances between Bertrand lens, objective, and eye-piece, lower the whole tube until the front of the

objective is down to the axis about which the mirror rotates. Use the plane side of your mirror, and reflect the image of a distant object, e g., a dot on a window-pane, *which must also be in the line of the axis of the mirror's rotation*, into the field of view so that the aforesaid dot will appear in the centre if the mirror is directly beneath.

If all is properly adjusted, on moving the mirror-bar to and fro, the dot will always appear reflected from the centre of the mirror. The angle through which the mirror-bar must be swung, so that the image of the dot may be first where the apex of one branch of the hyperbola was and then where the other apex was, will be the optical angle in air (2E). The angle, which may be swung from where the dot disappears on one side to where it disappears on the other, will give the angular aperture of the objective used.

SUBDIVISIONS OF THE AZOIC ARCHÆAN IN NORTHERN MICHIGAN.

BY M. E. WADSWORTH, STATE GEOLOGIST, HOUGHTON, MICH.

THE work of the Michigan Geological Survey in 1890 made it clear that the Azoic system of the Lake Superior district of northern Michigan was composed of at least three unconformable formations. This conclusion was published by me early in 1891, in an article entitled "A Sketch of the Geology of the Marquette and Keweenawan Districts," which was appended to a pamphlet called "Lake Superior -- Along the South Shore," New York, 1891. These general conclusions have been confirmed by the work of the two subsequent seasons, and two other unconformable formations rendered probable, although not yet proved conclusively. A discussion of these points will subsequently be given in detail in the reports of the State geologist.

The following are the formations as made out and named from prominent localities by the Michigan Survey, commencing with the oldest. There are given with this the formations as determined by the United States Geological Survey, showing their supposed equivalency.

	Michigan Geological Survey.	U. S. Geological Survey.
Azoic, or Archæan, System.	Laurentian (?) Period. — Cascade Formation.	Fundamental Complex.
	Huronian (?) Period. — Republic Formation. Menard Formation.	Lower Marquette Series.
	Michigan Period. — Holyoke Formation. Negaunee Formation.	Upper Marquette Series.

POTATO SCAB.

BY H. L. BOLLEY, FARGO, NO. DAKOTA.

THIS disease of the potato-tuber need not longer mar the appearance, quality, and economic value of the crop. The corrosive sublimate treatment, recommended in Bulletin No. 4, of North Dakota Experiment Station, has had another year's trial, not only at this station but by potato-growers, and it has again proven effective in a degree beyond previous expectation. Though the damage done each year by this disease is so great and widespread in its occurrence, no plant-disease now successfully combated is so easily prevented and at such a slight cost.

As indicated in my work of previous seasons, it is again demonstrated this past season that the damage to the yield of the crop is very much in excess of that usually supposed. The disease attacks not only the tubers but the base of the vines also; the result is a shorter-lived vine, a greater number of potatoes set upon the vines than there would be under normal conditions, and, third, much smaller tubers. The second of these statements, perhaps, needs some explanation. I have only one to offer, which I think to be about the correct one, i. e., the disease early attacks the young tubers as they set upon the vines, normal growth is checked, and the excess of vigor in the vines which is at its highest stage at this time finds expression in the formation of new tubers to the further detriment of those already set upon the stems.

The results of this summer's work when averaged for all tests show an average gain of one-half pound per hill in favor of the treated seed-tubers, and 99.33 per cent of total product void of disease; while untreated seed in all cases gave a product in which less than one per cent undiseased tubers were found.

The cost of treatment for a crop of two or three acres of potatoes need not exceed fifty cents, aside from that of one or two days' extra labor.

Details of the season's work will soon appear in bulletin form.

THE fourteenth edition of Franklin Leonard Pope's "Modern Practice of the Electric Telegraph" has just appeared (D. Van Nostrand Company, 234 p., 8°, $1.50). This is a technical handbook for electricians, managers, and operators, and contains 185 illustrations. As this book has been a standard authority on telegraphy for almost a quarter of a century, it is unnecessary to say anything to those already familiar with it, except that it has been rewritten, enlarged, and brought to date. To others, it is sufficient to repeat that this is the fourteenth edition of a comprehensive and handsomely illustrated work.

— The Johns Hopkins University has published a large geological map of the vicinity of Baltimore, prepared by Professor G. H. Williams. It is an extension of a similar map prepared by Williams and Darton and published by the U. S. Geological Survey some months ago; but the coloring on the present issue departs from the color system adopted for the Survey maps; as if experimentally to try another device, better applicable to the region here included. The experiment is successful; but it does not follow from this isolated instance that the color scheme of the Survey should be changed in its uniform application to the great series of maps for which it was prepared.

— The Geological Survey of Missouri, Arthur Winslow, director, has issued an atlas report on the Higginsville map-sheet, with two colored maps and several papes of text, chiefly concerning the coal measures of the region. The large form of the report avoids the difficulty of folding the maps, which constitute its chief feature; but the size of the atlas is inconveniently large for easy keeping in the library or on the desk. As a forerunner, however, of what we shall have to deal with when the publication of similar atlases of maps and texts is begun by the U. S. Geological Survey, the Higginsville atlas gives us useful practice. The extension of such a series of reports to include the other map-sheets of Missouri will add greatly to our information about that State.

— Professor F. A. Forel of Morges, Switzerland, has long been known as a careful investigator of the natural history of Lake Geneva, on whose borders he was born and bred. Several years ago he published a small pocket volume on the various features of the lake; and now we receive from Rouge of Lausanne the first of three volumes, entitled "Le Léman; Monographie Limnologique." Judging the whole work by what now appears, as well as by the high standard of Forel's previous writings, it is not too much to say that it will take an eminent place among scientific monographs, ranking with Favre's "Alps of Savoy" and Heim's "Mechanism of Mountain-Making." The division of the present volume which will excite most general interest is the serious discussion of the origin of the lake, from which Forel concludes that, of all suggestions, the one which ascribes the basin to the warping of a pre-existent valley is by far the most probable. The winds of the lake are fully described; but in the excursions in connection with them into the theory of cyclones and anticyclones, the author evidently ventures into a field somewhat unfamiliar to him; his suggestions on this subject not being made in view of all that is known about it. The second volume will include an account of the *seiches*, or oscillations, of which Forel has already written so much; the third will discuss the biology of the lake and its human antiquities. An excellent map accompanies the first volume.

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Attention is called to the "Wants" column. It is invaluable to those who use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The "Exchange" column is likewise open.

ON NATURAL AND ARTIFICIAL IMMUNITY.

BY O. LOEW, MEMBER OF THE UNIVERSITY OF MUNICH, FORMERLY MEMBER OF THE WHEELER EXPEDITIONS, WEST OF THE 100th MERIDIAN, OF THE U. S. CORPS OF ENGINEERS.

SINCE the beginning of the extensive bacteriological investigations of Pasteur, about twenty years ago, the new-born science of bacteriology has developed to gigantic proportions, and, although this science is still in its youth and capable of an immense extension, it has become of an extraordinary importance and of universal interest. No other science can boast of such rapid development. Many investigators botanists, hygienists, physicians, and chemists, have contributed their share to raise the science to an imposing figure. We name here above all: C. Nägeli, R. Koch, Rudolf Emmerich, Hans Buchner, M. Nencki, the Italians Tittoni and Cattani, the Americans Billings and Dixon, the Japanese Kitasato and Tsuboi, the Englishman Hankin, and the Germans Hüppe, Scholl, and Baumgarten.

It was Koch who invented excellent methods of isolating different bacteria species and made us acquainted with the bacillus of tuberculosis and the comma-bacillus; Kitasato isolated for the first time the bacillus of influenza and of tetanus (lockjaw); Nencki, Krieger, Hüppe, and Scholl isolated poisonous albuminous products of different bacteria species. But it was essentially Professor Rudolf Emmerich of Munich,[1] whose everlasting merit it is to have taken the first successful steps for solving the mystery of natural and artificial immunity.

We know now that nine-tenths of all diseases of man and animals are due to certain bacteria species that either by the lungs or by the stomach enter the body, multiply in the blood, and yield poisonous secretions that finally attack the nervous system and kill the body if no powerful reaction sets in that kills the bacteria, while their poisonous secretions are expelled by the body by oxidation or by the excreta.

Now, this reaction against bacterial evil-doings is the most interesting and marvellous process in the science of bacteriology and medicine, a process that was surrounded by a deep mystery, and the more interesting as it became evident that an animal having passed through a certain infectious disease, had acquired a certain resistance for a certain period against the same cause of disease. Experiments of Pasteur had shown this to be the case in various diseases. This resistance gained by passing through an infectious disease is known by the name of artificial immunity.

There exists, however, also a natural immunity, that is, the resistance of certain animal species against certain kinds of bacteria, without ever having passed through an infectious disease. For instance, rats and dogs are incapable of getting tuberculosis or swine plague (roth lauf), rats are incapable of anthrax, most animals are incapable of typhoid fever and Asiatic cholera.

It was Professor Emmerich who discovered first, in 1886, that the blood of an animal that had recovered from an infectious disease can cure another animal from the same disease or even prevent the development of the same disease if subcutaneous injections are made. He had proved, for the first time, that the bacteria in question are killed rapidly in the blood of an animal that had acquired immunity. He supposed, at that time, that there are formed certain albuminous combinations that act as poisons upon the barteria. Sometime afterwards, H. Buchner proved indeed that the fresh blood of various animals contains albuminous bodies detrimental to bacteria and that the natural immunity is thus easily explained, while for the artificial immunity this was proved later by Emmerich. This was to many a remarkable surprise, for all albuminous substances had been heretofore considered as the best nutrition for every living cell.

But this surprise was not altogether justified, for two Americans, S. Weir Mitchell and Edward Reichert, had demonstrated that the poison of the rattlesnake consists of two albuminous bodies, and a little later such poisonous combinations have been isolated from the seeds of *Abrus preratorius* and of *Ricinus communis*. Now, if there existed albuminous bodies noxious for the higher animals and not for bacteria, there could not more be wondered at, if albuminous bodies existed noxious to bacteria and not for animals. There exists, however, a third class of albuminous substances (proteids) noxious to both animals and bacteria.

Here must be mentioned, also, the theory of Metschnikoff in regard to the disappearance of bacteria in the blood of an infected animal. He had observed that the white blood-corpuscles or lymphatic cells devour living bacilli, for instance, the bacteria of anthrax, and he believed therefore, this to be the principal way to get rid of the entered bacteria. This theory of the phazorytose, however, did not give sufficient explanation in several regards.

The investigations of Professor Rudolf Emmerich have shown us that the albuminous bodies of the serum of dogs' blood, when precipitated by alcohol and redissolved in water containing 0.4 p. mille caustic soda had microbicide properties even then, if by the treatment with alcohol this property had been lost in consequence of a slight chemical change. This proved that a certain atomic constitution can be restituted by the very diluted solution of caustic soda. Not so easily changeable by alcohol is, however, the albuminous body causing the artificial immunity, as Emmerich has found, and while it is easy to cure with blood of artificially immunized animals, no one was able until now to observe a cure by application of blood of naturally immune animals. One cannot immunize, for instance, with dog's blood against tuberculosis of man or with the blood of rabbits against typhoid fever.

Professor Emmerich and Professor Tsuboi have investigated the blood of rabbits that were artificially immunized against swine-plague (roth laut). The serum of this blood was (after separation of the globulin) concentrated at 42° C. in vacuo, whereby an albuminous body of prominent curing properties was precipitated. The filtered liquid, however, gave upon precipitation with alcohol also a substance of the same curing qualities. This substance was washed with alcohol and ether and dried at a low temperature. This dry powder possessed all the curing properties of the blood itself against swine-plague. Thus we have for the first time the curing substance (Heilsubstanz) in a dry state, although mixed yet with inactive albuminous substance. This is a fact of immense importance, the most important discovery in bacteriology relating to medicine. Emmerich and Tsuboi gave also a plausible theory in regard to the formation and the mode of action of this remarkable substance, as may be studied in their publication, "Die Natur der Schutz und Heilsubstanz des Blutes," Wiesbaden, 1892. We hope to communicate later more of the investigations of Emmerich and Tsuboi.

A few additional remarks may be permitted to the writer. The great admirable transatlantic republic, with its unrivalled wonderful development, with its immense natural resources, and an unheard of liberality and magnanimity and generosity of

[1] Professor Emmerich is the most successful student of the far-famed hygienist, Professor Dr. Max v. Pettenkofer of Munich.

prominent citizens, as Senator Sanford, Johns Hopkins, Clarke, Lick, Cooper, etc., ought also to take the development of bacteriological research in consideration. Should there not exist a second Lick, who will help revealing with microscopes mysteries of just as high interest and still more practical bearings, like the first Lick with his telescope helped to reveal mysteries of the heavens? Thus far Europe is ahead in such studies, but I know that the ambitious Americans want to excel all other nations in every respect. The United States is bound to become in every scientific branch the first country on earth. This is my firm conviction.

SOME RELICS OF PRIMITIVE FASHIONS IN INDIA.

BY MR. KEDARNATH BASU, COR. MEMB. ANTHROP. SOCIETY, BOMBAY.

"THE ideal," says Theophile Gautier, "torments even the rudest natures. The savage who tattoos his body, or plasters it with red or blue paint, who passes a fish-bone through his nostrils, is acting in obedience to a confused sense of beauty. He seeks something beyond what actually is; guided by an obscure notion of art, he endeavors to perfect his type." Coquetry and neoterism are the peculiar characteristics of man. From the dawn of the Stone Age onwards man is known to have adorned himself with feathers, coral, shells, bone, wood, and stone ornaments; but the exact time when he commenced painting and tattooing his body and face is beyond the ken of history.

Tattooing the body and the face is one of the favorite, though painful, methods of adorning the body among savages, more especially among the Polynesian Islanders. This savage ornamentation of the body has permeated many of the so-called civilized and semi-civilized people, such as the modern Hindoos, the Burmese, etc. There is no mention of this savage and rude art, to my knowledge, in any of the ancient Sanscrit works, where other methods of decorating and ornamenting the body in all times and on all occasions are put down in detail. This art, if it may be so called, was not known to the aborigines of India till a recent date, and it may, therefore, be surmised that the Hindoos borrowed the rude and savage art from some race or races outside of India. I strongly incline to believe that this practice came to India from the Malayan Archipelago through Burmah to eastern Bengal, and through southern India upwards to the whole northern part of India.

The rude and savage custom of tattooing is still in vogue among almost all classes of Hindoo females and in almost all parts of India. The face, chest, and the arms are generally tattooed with varied and fantastic designs. The remnant of the savage custom of painting the person is to be seen in the red paint over the forehead, extending to the crown, among the married women of India. Both of these customs are rapidly waning with the refinement of the people. I do not see the same profusion, as I saw ten or twelve years ago, of tattoo-marks and red-ochre or red oxide of lead (*sindur*) over the forehead and crown among the women of Bengal. The rapid stride of female education and the consequent refinement in æsthetic taste are the causes of the decline of this rude and savage adornment; but the people of Behar, the North-Western Provinces, etc., still cling to these remnants of savagery. The up country women, besides tattooing their bodies and painting the head with red paint, bore the lower lobes of their ears, and insert big and heavy wooden cylindrical plugs, which almost sever the lobes from the ears. The plugs are sometimes as big as two inches in length with a diameter of an inch and a half, and as much as two ounces in weight. These heavy plugs pull down the lobes of the ears as far as the shoulders, and give the wearers a hideous look. The Marwaree women, besides tattooing their bodies and faces, ornament their upper incisors by drilling holes and plugging them with gold, and sometimes with carvings or engravings. The latter ornamentation is usually in the form of two or more concentric rings. The women in the North-West Provinces, Behar, Bengal, and elsewhere sometimes, color their teeth black with a kind of astringent tooth-powder, called *misi* or *manjan*. Painting the feet with scarlet paint (*alakta*) is prevalent among the Hindoo women from a remote age. The Mahomedan women, and the Hindoo women after them, paint the tips of their fingers and the palms with *henna* (*Lawsonia alba*) leaves. The Jains, on certain social ceremonies, paint their hands and feet with *henna* leaves. The up-country and Marwaree women wear their *sarees* and petticoats below the navel, and artificially cause the muscles of the belly to hang down loosely in a fold over their wearing apparel, thus causing an ugly appearance to the contour of the trunk. Some of the men also adopt this fashion, and destroy the natural beauty of the abdomen.

The Burmese men tattoo their entire bodies from the legs up to the chest and shoulders with blue and red pigments, with designs of animals and dragons. The lower limbs from the waist down to the ankles are tattooed in blue, while the parts above the waist are ornamented in red. These people tattoo their bodies as a mark of manhood, and ascribe special *charms* to every particular design. A Burmese priest or *phoongie* told me that men only are decked with tattoo-marks, the women do not mar their natural beauty with permanent pigments. The Burmese women look down with contempt upon men who fail to tattoo their persons, and would not marry a man who has not been tattooed. But the *Mugs*, both men and women, tattoo their bodies.

The wings of butterflies and wing-cases of beetles were, and are to some extent, in use as ornaments among the women of India. The wings of butterflies have now given place to artificial ones, made of mica sheets and paints, which, however, bear the name of butterflies or *ticklies*. The wing-cases of gaudy beetles are still in use in Bengal and elsewhere. The wing-cases of the Indian blister-fly (locally known as *Kánch pókd*, or glass insect), are generally used by women of Bengal. These wing-cases and *ticklies* are worn stuck upon the forehead, in the space between the eyebrows, or a little above it.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

The editor will be glad to publish any queries consonant with the character of the journal.

Notes on a Captive Pocket-Mouse.

IN November, 1889, I found a pocket-mouse (*Perognathus fallax*) in one of my traps, alive and unhurt, though torpid with cold, and took a fancy to keep it a captive to study its habits. It warmed slowly, and was some hours in regaining its usual state of activity. I have found individuals of other species and genera of this family (*Saccomyidæ*) chilled in traps, and it seems probable that, while they can bear considerable cold if free to move about rapidly, if compelled to keep quiet, they speedily succumb to cold. On this November morning the cold was sufficient to produce but a slight rime on the grass. This pocket-mouse was not wild, but allowed handling freely from the first. It would walk up my sleeve, around my neck, and down the other arm, and for a year or more would not try to jump to the floor, but later it seemed to have lost the sense of depth, and now it will jump down after a little walking about, even if the fall is far enough to injure it. It has never tried to bite me, and will quietly bear stroking and carrying about in my hand, though it seems to be getting somewhat wilder. I put it in a wooden box of perhaps a cubic foot in capacity, and put in an inch or so in depth of dry sand. For the first two years its habit was to dig and scratch in this sand each night, often making noise enough that I could hear it through my closed bed-room door, just outside of which the box was placed, but I never heard it scratching in daylight, and for some months I have not heard it in the night. It has not gnawed the wood as true mice would have done, and has not lifted the lid, which was kept closed by but its weight. If taken out of the box after dark and turned loose on the floor of the sitting-room, it moves about actively a few minutes, usually by short, deliberate, rabbit-like jumps, but if frightened it leaps two feet or more, as if shot off by a spring. After it has satisfied its curiosity, it creeps into some dark place behind a piece of furniture. In daytime it hunts a dark place immediately, if al-

lowed to, and is easily caught, while after dark I must corner it to catch it. I have heard it make no vocal sound save a slight squeak if accidentally hurt. It appeared to be fully adult when caught, but I have no other means of knowing how old it then was. It now acts as if feeling the effects of age. At first I tried feeding it grain, seeds, and green food. It would eat no green food that I gave it and would not touch water. For two years I have given it only dry barley or dry wheat and no water. It seems to prefer the wheat. It is a mystery to me how such an animal can live and thrive for years on dry grain without water or moisture in any form. Once or twice a year I empty its box and put in fresh, dry sand, and set the box in an angle in the hall where it is perfectly dry. I put nothing more in the box but dry grain and a little cotton to make a nest of, yet under these conditions it has lived three years. Many birds and animals do not drink water, or but rarely, but most such eat either green food, soft insects, or freshly-killed flesh, from all of which sources some moisture is obtained.

From where does my pocket-mouse get its moisture? Some seems necessary to make blood, replace water evaporated from the lungs and skin and other waste. F. Stephens.

Santa Ysabel, Cal., Nov. 22.

Confusion in Weights and Measures.

The interesting article in *Science* Nov. 25, on "weights and measures in England versus the decimal and metric system," recalls to my mind the difficulties I once experienced in stating the value in grains of a U. S. gallon of water at 60° F. A telegram was handed me one morning, requesting the above information, and I requested the messenger to wait until I had written a reply. Much to my astonishment, there existed the greatest confusion among the authorities upon this simple point, and it took me several months of investigation before I could write a satisfactory answer to the above telegram. Among the values noted were the following:—

U. S. Pharmacopœia, 1870,	58328.8862 grains.
" " 1880,	58329.6 "
Miller's Chemistry,	58317.3 "
Am. Chemist, Vol. I., p. 318,	58319.8 "
U. S. Dispensatory (last edition),	53328.886 "
Oldberg's Weights and Measures,	58335.218 "
U. S. Treasury Department,	8.3312 pounds.

The report on "Weights and Measures," by the Secretary of the Treasury (Senate Doc., 1857), says: "The gallon is a vessel containing 58372.2 grains (8.3389 pounds avoirdupois) of the standard pound of distilled water, at the temperature of maximum density of water, the vessel being weighed in air in which the barometer is 30 inches, at 62° F."

In view of all this confusion I thought it best to calculate a value for myself, basing my work upon the weight of a cubic inch of water as given in Barnard's "Metric System." My result was: "The U. S. gallon of distilled water at 60° F., weighed in air at 60° F., with barometer at 30 inches, weighs

58334.94640743 grains.

Referring to this result, Dr. Rice, Chairman of the Committee of Revision of the U. S. Pharmacopœia, was good enough to say: "Until further information is supplied, the value reported deserves preference before all others. It seems, however, highly desirable that this whole question of standards and relation of weight to measure, be finally settled by law, and preliminary to this, by a new scientific investigation which might be most suitably conducted under the auspices of the National Academy of Sciences or some other representative scientific body."

This U. S. gallon, of which we have been speaking, is, as is generally known, a survival of the old English wine gallon of 231 cubic inches, which has become disused in England since the Imperial gallon was introduced in 1826. It is not generally known, however, that although dignified by an apparently "standard" title, the U. S. gallon has no statutory existence whatever. In this lack of formal recognition the gallon does not stand alone, for not one of our common weights and measures, with the single exception of the "Troy" pound has any place upon the national statute books. In 1873 an act was passed providing that "For the purpose of securing a due conformity in weight of the coins of the United States, the brass troy-pound weight procured by the Minister of the United States at London in the year 1827, for the use of the mint and now in the custody of the mint at Philadelphia, shall be the standard troy pound of the mint of the United States, conformably to which the coinage thereof shall be regulated." Thus even the troy pound is seen to have no official recognition for general use, but only for the special purposes of the mint.

It is curious in this connection to note that the metric system, as a whole, was legalized in this country by act of Congress of July 28, 1866. The act reads: "It shall be lawful throughout the United States of America to employ the weights and measures of the metric system; and no contract, or dealing, or pleading in any court shall be deemed invalid or liable to objection because the weights or measures expressed or referred to therein are weights or measures of the metric system." By act of Congress the Secretary of the Treasury was directed to furnish each State with "one set of the standard weights and measures of the metric system." It is true that an act passed June 14, 1836, directed a distribution to be made to the several States of complete sets of "all the weights and measures adopted as standards," reference being made to the weights and measures then and now in common use, but it will be found upon inquiry that the expression "adopted as standards" refers to an action of the Treasury department made on the recommendation of Mr. Hassler in 1832, and not to any action on the part of Congress.

To quote from the report of the Secretary of the Treasury for 1857:—

"The actual standard of length of the United States is a brass scale of eighty-two inches in length, prepared by Troughton of London, and deposited in the Office of Weights and Measures. The temperature at which this scale is standard is 62° F., and the yard-measure is between the 27th and 63d inches of the scale."

"The gallon is a vessel containing 58372.2 grains of the standard pound of distilled water, at the temperature of maximum density of water, the vessel being weighed in air in which the barometer is 30 inches at 62° F."

"The standard of weight is the troy pound, copied by Captain Kater in 1827 from the imperial troy pound. The avoirdupois pound is derived from this; its weight being greater than that of the troy pound, in the proportion of 7,000 to 5,760."

This troy pound was, as has been said, afterwards recognized by act of Congress, thus becoming distinguished from the other so-called "standards." William P. Mason.

Rensselaer Polytechnic Institute, Troy, N.Y., Dec. 13.

Is There a Sense of Direction?

On the first of May last, my camping outfit started from Austin, Texas, bound for the northwestern part of the State. They went through the country, taking with them our camp dog, "Old Rock," a common cur.

Professor Cope of Philadelphia and myself joined the party at Big Springs, two hundred and fifty miles from Austin. Our destination was the upper Red River and the Staked Plains. We travelled northward along the foot of the plains, sometimes without a road, for about one hundred and fifty miles. Thence we went west one hundred miles, and thence south across the high plateau of the Staked Plains one hundred miles. Thence we turned east, crossing our former route at Clarendon, continuing southeastward to Archer County, a distance of one hundred miles. We then went southwestward seventy-five miles, and then back eastward to Archer and Montague Counties. From there we turned southward to near Dallas, where I disbanded my party, and started my outfit back to Austin, the last of October. We had been in the field six months. "Old Rock" had faithfully followed the wagon except at one time, when, his feet getting sore from travelling in the hot sand, he had been hauled for a few days.

After the outfit started for Austin and when at Hillsboro, one

hundred and thirty miles from Austin, they lost the dog. We had travelled, in a general way, around two sides of a triangle, and were now making the third when the dog got lost. A few days ago, one month from the time he got lost, the dog came back home, fat and foot-sore.

Now it was utterly impossible for him to have taken the back track and to have returned home by the way we went out. How did he find the way from Hillsboro to Austin, if he had no sense of direction? for he had never been over a step of the way between the two places. W. F. CUMMINS,

Texas Geological Survey, Austin, Texas, Dec. 2.

The Need for Popular Scientific Instruction on Oriental Subjects.

THE prevailing fad for the uncanny and the remote, having passed beyond the stages of spiritism and "Korashan science" into those of Neo-Buddhism and "theosophy," is rapidly taking shape as an eager curiosity for information regarding the religious and philosophical ideas, the literature and the customs of the far-east, coupled with a tendency to look there for a fuller light and a more perfect practical direction to life than the religion and science of Christendom can afford. They who look upon the cultivators of this taste as grossly astray from the path of reason and common sense must assign the source of the delusion to an ignorance of the real character of that Oriental civilization to whose meretricious fascinations they have succumbed.

Those, on the other hand, who are more or less in sympathy with the orientalizing movement will, if perfectly sincere, retort that the contempt for Oriental ideas, or indifference to them, which exists in various degrees among the greater public, results from the prevalence of gross misconceptions regarding them, and a lack of familiarity with the literatures which express them and the social conditions in which they are practically realized.

The two parties are agreed, therefore, that more light needs to be thrown upon the subject; that there is, in fact, a crying need among the people at large for accurate information on Oriental subjects.

The same antithetical concord, if I may be permitted the expression, exists between the defenders and opponents of the historical accuracy of the Hebrew Scriptures. Both urge the necessity of a wider diffusion of the results of recent Egyptological and Assyriological researches.

The world is becoming so small since the apparition of steam and electricity, in their protean applications, that the thought and life of one portion of it can no longer be a matter of indifference to another, even the most remote; and a man can no longer be considered cultured whose thought and sympathy are limited by the boundaries of a nation, the shores of a continent, or the formulæ of a cult. No religion, and no social conditions, can be considered otherwise than as anachronisms, which are unable or unwilling to bear an impartial comparison with all others of every country and every age.

And if a truly scientific conception of the history and needs and destiny of humanity be the great desideratum, it is clear at the first glance that it can never be attained until we cease to identify humanity with the little ethnic, or geographic or religious group to which we may chance to belong; and we can never cease to do this until we have become far more familiar than we at present are with those oldest and most powerful of civilizations which have their seat upon the Asiatic continent.

For the student of anthropology there are other and special inducements for the fullest possible exploitation of the Oriental lands and peoples. They alone have a known history of a sufficient extent to be of any marked value in unravelling the numerous problems connected with the history of progress and the phenomena of retrogression. It is the East which has afforded, or must afford, the key to the chief enigmas of ethnology, of philology, of archæology, and, above all, of *hierology*, or comparative religion. In India we can follow the trend of philosophical speculation, and the changes of religious thought and sentiment, either internally elaborated or exteriorly impressed, for a period of not less than 3,200 years; the less intense and all-absorbing religion of the Turanians can be traced backward through more than six thousand years to the lowlands of Mesapotamia or the plateaus of the Altaï; and in relatively modern times we are permitted to witness in the history of Buddhism the successive metamorphoses of a great cult in the course of its transmigrations from country to country, from continent to island, from lowland to upland, from the monkhood to the people, from the Aryan to the Turanian stock, from an agnostic or atheistic to a pantheistic, a dualistic, a monotheistic or a polytheistic form.

The wonderful richness of this field for the student of the history of religions would suggest that if a medium of popular instruction in Oriental lore could be established, it might well afford expression at the same time to that fascinating and all-important science.

A recognition of the needs, some of which I have here roughly outlined, has induced me to undertake the publication of a bi-monthly magazine, whose object will be an impartial presentation, from every point of view, of all branches of Oriental science and every aspect of the comparative history of religions. I shall be glad to have the coöperation of all who are at all interested in these subjects. MERWIN-MARIE SNELL.

Washington, D.C., Office of the Oriental Review, 2,128 H Street, N.W.

Algebraic Notation.

IN a communication to *Nature*, issue of Nov. 3, W. Cassie points out the advantages of a proposed new notation for indicating algebraical operations. In addition to the oblique line for division (now in use in some English scientific works), another oblique line, from left to right downwards, is employed to denote an exponential operator. Thus the quantity which follows this sign is the exponent of that which precedes. In complex expressions the lines also perform a bracketing function. Besides these two marks the radical sign is used to denote evolution, and it is this which the writer deems inexpedient.

In algebra the employment of both radical signs and fractional exponents adds unnecessary confusion to a subject rather difficult in itself. There is no good reason — except that both are in use — why both should be retained. The fractional exponent notation, of course, must be kept, since it serves for all cases; and there is certainly very little justification for setting apart a special symbol for indices whose numerators are unity. I tested all the radical expressions given in the letter referred to and found no difficulty in writing them in the fractional exponent notation. Indeed, the figure 1 in the numerator might be omitted, being understood. The symbol resulting suggests the radical sign itself, only that the quantity precedes and the exponent follows the sign. A notation which avoids all special spacing and various sizes of type, writing all expressions in ordinary letterpress has certainly a worthy aim, and it would be a pity to burden it with an unnecessary symbol out of symmetry if not out of harmony with another. JOSEPH V. COLLINS.

Miami University, Oxford, O., Nov. 30.

Electric Phenomena on Mountains.

TWO notes of great interest regarding this subject have appeared in this journal for Sept. 23 and Dec. 2. The phenomena of electric discharges from elevated points on the earth's surface were first noted, so far as I know, by a savant on the great pyramid in Egypt. As he stood on the pyramid with a bottle held at arm's length above his head, he heard the peculiar spitting and sputtering produced by the electricity passing from the bottle. The description by Mr. Stone is especially valuable, and shows the extreme importance of making careful observations. Close attention is being paid by the Weather Bureau to all manifestations of this kind on Pike's Peak. It is my impression that the origin of the phenomenon is not an electric cloud passing overhead but a discharge from, or to, the earth under an electric strain or change of potential. A mountain summit forms a point for discharge of electricity like a point on the conductor of an electric machine. On Mt. Washington this discharge frequently

continues all night. One frequently finds it impossible to sleep there though in the very best of health, and this is directly attributed to the electric discharge, this fact is noted by Mr. Stone.

To my mind the most important line of investigation is that regarding the connection between this discharge and the agglomeration of vapor molecules into cloud particles. Experiments have already shown a most marked effect upon steam when an electric discharge is passed into it. On Mt. Washington there are dense clouds weeks at a time, while a mile or two from the summit the sky may be perfectly clear. A most careful study of the phenomenon has shown that it could not be due to the rocks of the summit being cooler than the air, as thought by many, for the rocks were always warmer than the air except on nights when there were no clouds. Nor could the persistent cloud be due to the expansion and consequent cooling of air rushing up the side of the mountain for the peak is a sharp cone at the last 500 feet and the cloud-hood extended on all sides to a mile or two. It would seem probable that a careful study with instruments of the phenomena of mountain electric discharges would shed a great deal of light on the exceedingly complex subject of clouds and rain formation about which we know nothing except that the ordinary theories need thorough revision. H. A. HAZEN.

Washington, D.C., Dec. 10.

A Multiple Key. — Preliminary Note.

IN psychological laboratories it is frequently desirable to make or break two or more electrical currents at the same instant.

Ewald's key solves this problem for the most simple cases, but a need for something more elaborate was felt. This led to the invention by Dr. Scripture and the construction in the work-shop of the Yale Psychological Laboratory of a multiple key which meets all present requirements. Ewald's key costs 20 marks; this one, made by the laboratory mechanic, of unlacquered brass, without platinum contacts, was made at a cost of less than $10.

It is arranged so that five currents can run through it. One, two, or three of these can be made and one broken at the same time. The other can either be made or broken at the same time or broken for an instant and then made again; or these makes and breaks can be adjusted so as to occur one after the other in any order. By reversing the key, it gives three breaks and two makes.

An illustration of the use of the key can be taken from one of the problems in reaction time now being investigated. A single movement of the key first breaks the shunt of the tuning-fork circuit and starts the time-marker vibrating on the recording drum; an instant later, say, .03 of a second, it closes a telephone circuit running to the reacting-room from the sound-room, thus producing the stimulus; it simultaneously breaks a current running through the registering signal on the drum and a closed key in the reaction room. This current is automatically closed again within .02 of a second, and again broken by the reaction on the closed key. As soon as the reaction takes place, the key is released and the tuning-fork curve stopped before the drum has made a complete revolution, thus saving all motion of the marker during the experiment, as well as space on the smoked paper. This not only saves much time, but also renders the records more legible and consequently more accurate.

CHARLES B. BLISS.

New Haven, Conn., Dec. 19.

Excitement Over Glacial Theories.

PROBABLY I have as much reason to be thankful for the frankness of Mr. McGee's letter in *Science* for Dec. 2, as for the courtesy of Dr. Brinton's previous review of my volume on "Man and the Glacial Period," for it doubtless gives expression to sentiments held by many persons in private, and it is better that I should have occasion to explain the misapprehensions which evidently prevail in some quarters. I beg, therefore, the privilege of your space for a brief statement of some points.

Mr. McGee refers to an apparent discrepancy between my observations on the rate of movement of the Muir Glacier and those of Professor Reid. If he had read Professor Reid's article carefully he would have seen that the discrepancy is more apparent than real. Professor Reid distinctly states that there was a quarter of a mile or more of width in the glacier which he was unable to reach with his stakes, and whose motion he therefore failed to measure, whereas by our method of taking angles directly upon the ice-pinnacles we were able to measure the portions which were presumably moving most rapidly.

As to my connection with the U. S. Geological Survey, the facts are that after I had, on the Pennsylvania Survey and at much private expense, mapped the glacial boundary from the Delaware River to Illinois, and published the results with considerable fulness, I was asked, in 1884, to complete the work to the Mississippi River for the U. S. Geological Survey and prepare a report on the whole line from there to the Allegheny Mountains. This I did, and the report was duly published in 1890. My formal connection with the Survey did not terminate until a month after the publication of my last book. I am not aware that any substantial error has been pointed out in my delineation of the southern border of the ice-sheet, which I was set to accomplish (see *The Dial* for Dec. 16, 1892).

The real point at issue relates to the question of the unity, or one might better say the "continuity" of the glacial period, and the disturbance all arises over the fact that I have been led to interpret the facts in accordance with the theory of glacial continuity, while Mr. McGee and some of his associates are committed to the theory that there were two or more distinct epochs. It is sufficient for me here to say that my conclusions are based on a large amount of field-work, and are supported by a respectable number of able geologists, and have recently been set forth at considerable length in an article in the November number of the *American Journal of Science*. In this I have not wholly disregarded Mr. McGee's science of geomorphy though I have not called it by that name.

Perhaps the best way for me to answer the charge of general ignorance will be to state in a few words the conception of the progress of events during the glacial period which I have been slowly led to entertain.

During the most of the Tertiary period the lands were low towards the pole and a warm climate prevailed. Toward the close of the Tertiary a slow elevation of these northern lands was in progress until they stood, say, 3,000 feet higher than now. This is shown by the fiords which characterize both sides of the continent from the latitude of Chesapeake Bay northward.

This elevation of land was probably the predominant cause of the glacial period, for the ice-movement in North America radiated, not from the pole, but from Labrador and the region about Hudson Bay. This elevation was accompanied by a rapid deepening of the river channels over the area and the consequent accumulation of detritus about their mouths.

Ice finally accumulated nearly a mile deep over the area north of the linemarking the "drift" and extending to New York City and Cincinnati. This accumulation of ice was coincident with, if not the cause of, a depression of the land in the more northern portions several hundred feet below its present level.

The final melting of the ice proceeded with great rapidity, but with various halts and oscillations of the front. The period of oscillation of the glaciers in the Alps is something like half a century. The periods during the great ice age were probably much longer, but a few centuries seems ample to account for the longest. These oscillations are marked by what Professor Cook aptly called "moraines of retrecession," of which there are twelve in Ohio.

Applying the principles of Mr. McGee's science of geomorphy, I explain the phenomena of slackened drainage which characterize the deposits along the extreme margin of the glaciated area as connected with the subsidence of the land increasing to the north, which marked the climax of the period, while the more vigorous signs of drainage action farther north are the natural results of the northerly re-elevation which went on synchronously with the unloading of the weight of the ice by melting. It is in these later stages of the deposition of ground that we find the remains of palæolithic man.

Whether this theory of the progress of events is correct or not,

it is based on wide observations of facts and long reflection on the elements of the problem, in which I have had the assistance and support of many able geologists, and they are views which cannot wisely be dismissed without careful consideration of the arguments upon which they rest. The theory is not without its difficulties; neither is any other. Geology is not an exact science. There is no infallible court of appeal for the settlement of theories. Observers and students of the facts may widely differ for a long time in their conclusions without discredit to either party. I can only ask for freedom of opinion and freedom of utterance.

G. FREDERICK WRIGHT.

Oberlin, O.

Notice of the Occurrence of Nyctale Richardsoni, Richardson's Owl, in Nebraska.

THE occurrence in this region of Richardson's owl, *Nyctale Richardsoni*, seems to be entirely established by the recent capture of one in Lincoln. This is a long distance below its southern limit, and its appearance is something of a surprise.

However, Professor Lawrence Bruner, who has stuffed and mounted this rare owl, noticed one as a boy, twenty four years ago, near Omaha. Ornithologists at the time questioned the accuracy of his observations, but this specimen confirms the probability of his claim.

The present specimen, which is the first actually taken in the State, was captured on 33d Street, in the city of Lincoln, Dec. 12, and was brought alive to the State Museum. It lived but a short time, however, owing perhaps to injuries, or to the heat. The bird is an adult, in fine plumage.

The unexpected appearance of this inhabitant of Arctic regions seems the more striking from the fact that the weather in Nebraska thus far, barring one snow-storm, has been a mild, protracted autumn rather than winter. ERWIN H. BARBOUR.

University of Nebraska, Lincoln, Neb., Dec. 14.

Vagueness of Localization in a Child.

The following are illustrations of the vagueness of the localization of cutaneous sensations in children. The one referred to is 16 months old. The morning after she had been vaccinated, and for a considerable time afterward, she was unable to tell on which arm the sensitive spot was situated, often looking at or touching the wrong one. On one occasion the child sat down with her back close to a grate-fire; as soon as the heat had penetrated the clothing, she began pulling at and striking her chest as though the sensation were there. M. SCRIPTURE.

New Haven, Conn.

Ballistic Galvanometer.

CAN any of your readers furnish me with complete references on the use of the ballistic galvanometer for measurements of time? E. W. SCRIPTURE.

Yale University, New Haven, Conn.

BOOK-REVIEWS.

The California Vine Disease. By NEWTON B. PIERCE Bulletin No. 2. Division of Vegetable Pathology, U. S. Dep't. Agric. Washington, 1892. 222 p, pl. 25, charts 2.

Report on the Experiments made in 1891 in the Treatment of Plant Diseases. By B. T. GALLOWAY. Bulletin No. 3. Division of Vegetable Pathology, U. S. Dep't. Agric. Washington, 1892. 76 p. pl. 8.

Grasses of the Pacific Slope, including Alaska and the Adjacent Islands. By GEO. VASEY. Bulletin No. 13. Division of Botany. U. S. Dep't. Agric. Washington, 1892. 50 plates, with descriptions.

THESE three publications which have followed one another rapidly from the Government printing office are of diverse character. The first deals with the results of an investigation extending over two years into the character of an obscure but virulent disease of vines in California; the second records the results of a series of experiments to prevent the ravages of several plant-diseases in the eastern portion of the country; and the third gives descriptions and plates of fifty-two species of grasses found growing on the Pacific coast of our country, including Alaska.

The California vine disease seems to have first appeared in the vicinity of Anaheim, Orange County, in 1885, but it did not attract great attention until the following year, when it caused the death of a large number of vines. From this, its first appearance, it has spread over a wide section of the surrounding country and has caused the death of many thousands of vines and entailed a loss of many thousands of dollars. Mr. Pierce, as the special agent of the Department of Agriculture, had spent two years in studying the subject when the present report was submitted, in June, 1891, and since then has continued his investigations. The report is an exhaustive one in many respects, an unsatisfactory one in others. For example, while he has given a very full account of the rise and progress of the vine industry in California and Mexico, and has examined with great care the bearings of soil conditions and of meteorological phenomena on the disease, the remedy for the evil, or even suggestions for palliation of it, are meagre in the extreme. It might be said, it is true, that as the origin and cause of the disease is still unknown, it is not possible to prescribe a remedy. Everything that has so far been tried has given negative results. Numerous facts have been brought out by the investigation. Among them may be noted that drainage, irrigation, soil characters, rainfall, and temperature have had no effect in causing the disease. But that shade has in some unknown manner the effect of retarding the progress of the malady. It has also been ascertained that the disease is not caused by certain species of fungi or by certain animal or insect parasites, and that it differs in several ways quite markedly from Chlorosis and Pouritiore as these occur in Europe. The colored plates that are given illustrate very well the effects of the disease on the leaves and canes.

The second of the titles above given is an account of experiments conducted in the vicinity of Washington and in New York State for the prevention of plant diseases. These experiments bear out the previous work of the department. They show that, in the treatment of black rot of the grape, Bordeaux mixture still takes the lead; and that half strength, i. e, 3 pounds of copper sulphate, 2 pounds of fresh lime, and 22 gallons of water, gives as good practical results as full strength. In the treatment of apple scab, Bordeaux mixture was also very effective, but not so much so as Paris green. This is a new fact inasmuch as this substance, while known to be effective against insects, has not been generally supposed to be a fungicide. There was a higher percentage of first quality fruits and a less percentage of third quality as well as wormy fruits when this substance was used than any other. The experiments in New York were largely negative, since the amount of disease present was comparatively slight. The subjects treated were various kinds of nursery stock, and here again Bordeaux mixture gave as a whole the best results. Two plates showing sprayed and unsprayed grapes bear testimony to the good effects of the treatment for black rot.

The third title, "Grasses of the Pacific Slope," consists of illustrations and descriptions of grasses growing in California, Oregon, Washington, and Alaska. Some of them are of value for forage, while others are of scientific interest only. This is Part I. of the second volume of "Illustrations of North American Grasses," the first volume, also in two parts, having treated of the grasses of the south-west. The reports cannot fail to be of great interest and value to all students of botany.

JOSEPH F. JAMES.

Comparative Architecture. By BARRE FERREE. The author, New York.

THIS is a reprint of a paper read before the American Institute of Architects at its twenty-fifth annual meeting, at Boston, in October, 1891. It is handsomely printed in royal octavo, and covers fifteen pages in clear and pleasing type. In this discourse, the distinguished author applies to architecture the comparative method which has proved so fruitful in the study of language and of biology. "Comparative Architecture" takes "the facts of historical and descriptive architecture, and describes the comparative progress made by all nations, and under all conditions."

It is thought that thus "the rich results obtained by the comparative method in natural and human sciences justify the hope that not less valuable returns will be obtained" by this extension of the system. Architecture falls under the domain of law, and the immense walls of the Assyrians and the ponderous arches of the Romans are the product, not of fancy, but of the condition of environment of their builders. Mr. Ferree believes with Freeman; "Deal worthily with the history of architecture and it is worthy to take its place alongside the history of law and of language." "Comparative architecture has to do with architecture as the product of the human mind, as the result of intellectual processes and reasonings; and each day these things enter more and more into the making of modern architecture." The paper is well worthy of the careful perusal of the architect whether professional or amateur.

Energy and Vision. By S. P. Langley. Washington, Nat. Acad. 18p. 4°.

This small volume contains, as is always expected of the papers of the distinguished astronomer and physicist, very important matter. The work was first presented to the National Academy of Sciences at its April meeting in 1888. It relates to the differing optical effects produced by waves of light of varying magnitude though containing equal energy. Two lines of research are marked out: the one to ascertain the quantity of energy in each ray; the other to measure the corresponding visual effect. In the first the "bolometer" of Langley is used to measure energy of various heat and light waves. Solar measures constitute the second. The result gives the value of equal amounts of energy at different points in the spectrum as affecting the retina. It was at once found that energy itself is not uniformly distributed in the spectrum. The gauge of energy was taken as the intensity of light required to read a table of logarithms; which method is thought more accurate than any of the usual photometric systems. It is found that the eye requires more time to regain its sensitiveness for violet light, after having been exposed to sunlight, than for any other color. It is found that the eye can perceive lights varying in intensity in the proportion of 1 to 1,000,000,000,000,000. The same amount of energy may produce 100,000 times as much effect in one portion of the spectrum as in another. Work done in giving rise to deepest red light amounts to about 0.002 erg per second.

Spons' Tables and Memoranda for Engineers. By J. T. Hurst Eleventh edition. New York, Spon & Chamberlain.

This is a little pocket-edition of Hurst's tables, and is likely to prove, as indeed the issue of eleven editions shows to be the fact, a very useful miniature reference-book. It is about one and a half by two and a half inches, and 140 pages of carefully selected tables and data, with a good index. It can be carried in the waistcoat-pocket. It is even smaller than the admirable little pocket-book published by the American Iron Works of Jones, Laughlin, & Co., and but a fraction of the size of Hurst's larger tables, of Molesworth, and other so-called pocket-books.

AMONG THE PUBLISHERS.

— The tenth and concluding volume of the new edition of "Chambers's Encyclopædia" will be issued by J. B. Lippincott Co. in a few weeks. Mr. Stanley Lane-Poole writes on Swift and Turkey; Mr. F. T. Palgrave contributes the memoir of Tennyson and that of Wordsworth, Mr. Richmond Ritchie that on Thackeray. Sir W. Lawson treats of Temperance, Mr. R. W. Lowe of the Theatre, Mrs. Besant of Theosophy, and Mr. G. Howell of Trades-Unions. Mr. Hamerton is the author of the biography of Titian and of that of Turner, while Mr. J. Gray writes on Van Dyck. The article on Anthony Trollope is by his brother, the late Thomas A. Trollope. Mr. Vámbéry writes on Turkestan, Professor Shaler on the Geology of the United States, Professor J. Geikie on Volcanoes, Mr. Austin Dobson on Horace Walpole, Mr. Loftie on Westminster and Windsor, Mr. Fraser

CALENDAR OF SOCIETIES.

Biological Society, Washington.

Dec. 17.—Principal topic of the evening, What should be the Scope and Object of a Biological Society? introduced by Mr. B. E. Fernow. Communications: Lester F. Ward, Frost Freaks of the Dittany; Erwin F. Smith, Notes on Peach Rosette; M. B. Waite, Destruction of Lichens on Pear Trees; D. G. Fairchild, Notes on Apple and Pear Fusicladii.

New York Academy of Sciences.

Dec. 19.—W. B. Scott, Fossil Hunting in the North-West.

New York Academy of Sciences, Biological Section.

Dec. 12.—The following is a synopsis of the papers: On the Miocene Deposits of the White River, by Dr. T. L. Wortman. These deposits were arranged in three groups, Lower, or Menodus, beds; Middle, or Orcodon, beds; and Upper, or Protoceros, beds. The Protoceros beds were regarded as in part contemporary with the John Day beds of Oregon. On the Ilco-Colic Junction of Procyon lotor and Allied Arcthoids, by G. S. Huntington. The absence of caccum in Procyon was noted as repeating the condition found in Hyena and the Ursidæ. The provision for preventing return of contents of large intestine appears to consist in a series of constructions in the terminal part of the ileum together with increase in the circular muscular fibres in these situations as well as at the ilco colic junction itself. There is a complete absence of an ilco-colic valve. On the Origin of West Indian Bird Life, by F. M. Chapman. Conclusions from study of bird (and mammal) life were (1) distinctness geologically of Lesser from Greater Antilles; (2) independence of islands and mainland since the appearance of the present fauna; (3) original connection of Indes to Central America by way of Jamaica, Central America at this time an archipelago created by passage leading from Pacific to Carribean Sea; (4) the older faunal forms of the Indes represent survivors of the insular Tertiary species; (5) the newer forms are immigrants and become differentiated under new conditions of living. H. F. Osborn reported the discovery in the Miocene of South Dakota of a horned Artiodactyl represented by male and female skulls and complete fore and hind feet. The female skull is comparatively hornless and proves to be identical with Protoceras celer Marsh. The male skull exhibits no less than five protuberances upon each side, or ten altogether. Two of these upon the frontals and sides of the maxillaries are very small; the parietal, supra-orbital, and maxilliary protuberances are very prominent and hed, apparently, a dermal covering, as in the giraffe. There are four toes in front and two behind, as in the early Tragulidæ. The types were found by Dr. T. L. Wortman, and are in the recent collections of the American Museum of Natural History.

Society of Natural History, Boston.

Dec. 21.—W. F. Ganong, Some New Experiments on the Absorption of Liquids by Aerial Parts of Plants; S. H. Scudder, The Abdominal Pouch of Butterflies of the Genus Parnassius; W. H. Niles, Columnar Structure in Stratified Rock.

Publications Received at Editor's Office.

George, Henry. A Perplexed Philosopher. New York, C. L. Webster & Co. 319 p. 12°. $1.

Hale, George E. Ultra-violet Spectrum of the Solar Prominences; The Yerkes Observatory of the University of Chicago; Some Results and Conclusions Derived from a Photographic Study of the Sun. Reprints. Chicago, The Author.

Newth, G. S. Chemical Lecture Experiments. London and New York, Longmans, Green & Co. 323 p. 8°. $3.

U. S. Navy Dep't Notes on the Year's Naval Progress. Washington, Government. 366 p., pl. 8°.

Rae on John Wilkes, Dr. Buchan on Wind, and Mr. Price Hughes on Wesley. Canon Isaac Taylor contributes the articles on Writing and on York and Yorkshire, and Cavendish that on Whist. Dr. Mills expounds Zend, and Mr. G. Saintsbury criticises Zola. The first volume of the new edition was issued in March, 1888, so that the work has been completed in less than five years — a very short time indeed when its magnitude is considered. The "Encyclopædia" contains over thirty thousand articles, contributed by nearly one thousand different writers, and includes among its contributors many of the chief authorities in various departments of knowledge.

— "Questions and Answers about Electricity," a small volume of 100 pages (50 cents) from the press of the D. Van Nostrand Company, is peculiar in some respects. It has four authors and one editor, and the latter, we fear, has taken undue liberties with the manuscripts of the authors. In no other way can we account for the presence of such words as "ampage," "furtherest," "shellaced," etc.; and such statements as, when cells are connected in multiple, the current can travel "only a few feet." Though intended specially for amateurs and students, we fear the book will prove more interesting to those "well up" in the subject. A glossary, by the editor, no doubt, adds to the originality of the work.

— "The Sloyd System of Wood-working" is the title of a 250-page volume from the pen of B. B. Hoffmann, A.B., superintendent of the Baron de Hirsch trade-schools, and just published by the American Book Co. (Price $1.) The book gives an excellent account of the theory and practical application of the Naas system of manual training, which has already received considerable attention in the volumes of *Science*. The first two chapters of the work give the clearest and most comprehensive exposition of the system we have seen; the third chapter (some things in which might better have been omitted for common-school purposes) gives a history of the manual training idea; the final chapters give an account of various model series and of the progress of the system in elementary schools.

— The D. Van Nostrand Company have just published "The Practical Management of Dynamos and Motors," by Francis B. Crocker, professor of electrical engineering in Columbia College, and Schuyler S. Wheeler, D.Sc. To the man in charge of an electric light or power plant this volume will prove invaluable, as it is the first book, as far as we know, devoted specially to their requirements. It gives simple and readily comprehended instructions in the practical use and management of dynamos and motors. The different subjects are treated separately and in logical order, and are arranged so as to facilitate ready reference on any point on which information is desired. ($1.)

— Metal-Coloring and Bronzing" is the title of a new 12mo volume of 336 pages just issued from the press of Macmillan & Co. (Price $1.) The book is the result of experiments and investigations carried on for eighteen months by Arthur H. Hiorns, principal of the metallurgy and engineering department of the Birmingham (England) municipal school; and is, we believe, the first systematic treatise on metal-coloring (more commonly known as bronzing) that has been published. The essential portion of the work is treated under three principal divisions, namely, chemical, electro-chemical, and mechanical metal coloring, the first being given greater space on account of its greater importance. The introductory portion contains a brief account of the properties of the ordinary metals and their chemical relations with regard to oxygen, sulphur, chlorine, etc.; and also deals with the chemical effects of the atmosphere on metals, the relation of metals to color, and chemical principles and changes. The rest of the volume is devoted mainly to the mechanical processes employed. As an authority on metallurgy the author of this work is well known; and this, with the fact that the book is the first in its peculiar field, insures for it a secure place in technical literature.

Exchanges.

[Free of charge to all, if of satisfactory character. Address N. D. C. Hodges, 874 Broadway, New York.]

For sale or suitable exchange.—A spectrometer made by Fauth & Co., Washington, D. C., according to the plan of Prof. C. A. Young. This instrument is suitable for the most advanced investigations and determinations. Cost originally $700 and has been used but little. Will be disposed of at a considerable reduction. Address Department of Physics, Ohio University, Athens, O.

I will send British land and fresh-water shells in return for those of America, any part, sent to me. I have at present about fifty or sixty species, with many varieties. W. A. Gain, Tuxford, Newark, England.

The Biological Department of Hamline University desires to offer microscopic slides of animal tissues, or whole animals, in exchange for first-class fossils. Address correspondence to Henry L. Osborne, Hamline University, Hamline, Minn.

For sale.—A set of the Berichte der Deutschen Chemischen Gesellscaft, from Jan. 1, 1877, to Jan. 1 1892, bound in twenty-six volumes to Jan. 1, 1888 and remaining four years unbound. Also the Bulletin de la Société Chemique de Paris, from Jan. 1 1879, to Jan. 1, 1892, bound in eighteen volumes to Jan. 1, 1888, and remaining four years unbound. Dr. Marcus Benjamin, care of D. Appleton & Co., 1 Bond St., New York City.

For sale.—1,500 bird, and 125 mammal skins, which are first-class and labelled with strictly reliable data. They were collected in this immediate vicinity and are preserved and made up according to the latest approved methods. As I offer the above at a very low price, it would be a good opportunity for a college or a museum. Willard E. Treat, East Hartford, Conn.

For Sale.—A new Model U. S. Army Hospital Microscope (Zentmayer), also ¼-inch and 1/12-inch Objectives. HENRY C. WELLS, 151 Broadway, New York.

Wants.

WANTED.—American Journal of Conchology, seven volumes. Parties having these for sale will please address the undersigned, stating condition and price. R. Ellsworth Call, Louisville, Ky.

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